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Two new species of *Tricolia* Risso, 1826 from South Africa (Mollusca: Gastropoda: Phasianellidae)

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ABSTRACT

Tricolia adusta sp. n. and *Tricolia saxatilis* sp. n. are described from the off-shore reefs of KwaZulu-Natal, South Africa. The characteristics of the shell are detailed, together with observations on the protoconch, operculum, radula and external anatomy. Similarity in the inner marginal radula tooth morphology and external anatomy suggests a relationship between *T. adusta* and *T. formosa* (Turton, 1932). In its globose shape and small size, *T. saxatilis* resembles no other southern African *Tricolia* species, and is more similar to certain small Mediterranean species such as *T. tingitana* Gofas, 1982, with which it also shares unusual features of the external anatomy. However, it appears to possess unique, possibly paedomorphic opercular features.

KEY WORDS: Mollusca, Gastropoda, *Tricolia*, new species, southern Africa.

INTRODUCTION

The southern African marine molluscan fauna includes perhaps the most diverse regionally endemic radiation of the phasianellid genus *Tricolia* in the world. Despite this, the local *Tricolia* fauna has never been systematically revised, and many species remain poorly known and inadequately diagnosed. In his studies of the molluscan fauna of South Africa Barnard (1963) mentioned many of the nominate taxa described by nineteenth and early twentieth century authors and by Turton (1932), correctly transferring them from *Phasianella* to *Tricolia*, but he did not adequately address their validity and confused taxonomy, and provided no species diagnoses or illustrations. Subsequent work on the *Tricolia* fauna of southern Africa has discussed only the common species (Kilburn & Rippey 1982; Steyn & Lussi 1998) or new regional records (Herbert 1991). However, valuable comparative studies of the *Tricolia* fauna of the Indo-West Pacific and W. Europe-Mediterranean are available (Robertson 1985; Gofas 1982, 1986, 1993), including some of the tropical *Tricolia* species occurring off northern KwaZulu-Natal. The present contribution forms part of a larger systematic revision of the southern African representatives of the family Phasianellidae (*sensu* Williams and Ozawa 2006, the *Phasianella–Gabrielona–Tricolia* informal grouping of Hickman & McLean 1990) currently underway, and for which it is necessary to describe new taxa in advance of publications discussing the phylogenetic and biogeographic relationships of the endemic southern African *Tricolia* radiation, based on morphological and molecular data.

MATERIALS AND METHODS

The bulk of the material of the new species we describe was identified amongst Natal Museum specimens collected over many years, primarily through the museum's dredging and diving programmes. Additional living material has been obtained more recently through targeted SCUBA diving on subtidal reef habitats off KwaZulu-Natal, South

Africa. Stones covered with algal turf and other marine encrustations were collected at depths from 15–40 m and brought to the surface where they were scrubbed and cleaned thoroughly in a bucket of seawater. The debris accumulated in the bucket was then examined under a dissecting microscope and the micro-molluscan material extracted and preserved in 75% ethanol after relaxation in 7% $MgCl_2$. The external anatomy of living animals was observed under a dissecting microscope immediately after collection. The radula, operculum and protoconch were examined at low accelerating voltage (5–10 kv) in a Hitachi S-570 scanning electron microscope. Photographs of shells were taken using a Leica MZ16 microscope with auto-montage camera, or a Nikon F4 camera with reversed 28 mm lens and extension tubes.

Abbreviations

CSIR	– Council for Scientific and Industrial Research, South Africa.
NMDP	– Natal Museum Dredging Programme.
NMSA	– Natal Museum, Pietermaritzburg, South Africa.
NPB	– Natal Parks Board (now Ezemvelo KZN Wildlife).
ORI	– Oceanographic Research Institute, South Africa.
a/l	– aperture:length ratio.
l/w	– length:width ratio.

TAXONOMY

Family Phasianellidae Swainson, 1840

Genus *Tricolia* Risso, 1826

Tricolia adusta sp. n.

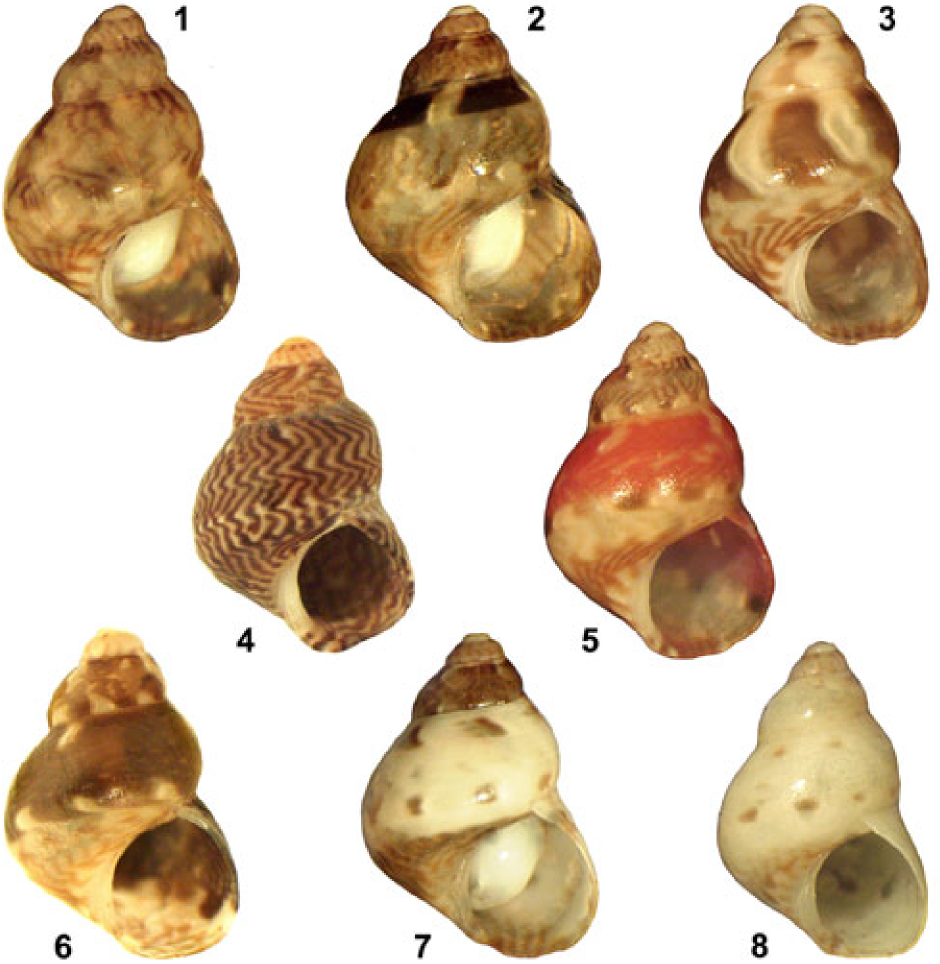
Figs 1–16

Etymology: *adustus* (Latin) – brown, referring to the predominately brown coloration of the shell.

Diagnosis: Shell small, elevated-turbiniform; whorls rounded, without any angulation, suture not strongly indented; smooth, lacking spiral sculpture and with only microscopic growth-lines; coloration highly variable, but typically buffish, patterned with zigzag brown axial lines and subsutural blotches, evidently never with pink dots on first two whorls or with bluish subsutural spots.

Description (Figs 1–8): Shell small, elevated-turbiniform; teleoconch of up to 4.5 whorls with weakly indented suture; whorls smoothly rounded, lacking any angulation, periphery slightly below mid-whorl and profile usually more strongly curving below this than above; apex broadly rounded. Sculpture weak, shell mostly smooth and glossy, marked only by exceedingly fine growth-lines. Aperture sub-circular, outer lip thin, interior without nacre; colour pattern visible internally; inner lip concave and slightly reflected; umbilicus closed in most specimens, remaining as a narrow chink in others.

Coloration extremely variable, typically buff to pale yellowish-brown, variously marked with zigzag lines in shades of darker brown, frequently bolder below suture; umbilical region often bordered by a spiral band of alternating dark and light blotches (Fig. 1); some specimens with large, dark brown to black, trapezoid blotches below suture (Fig. 2); others with broad, alternating axial bands of brown and cream-white on apical surface (Fig. 3); occasionally boldly patterned with close-set, red-brown to dark



Figs 1–8. *Tricolia adusta* sp. n., variation in shell colour and pattern: (1) holotype, length 3.30 mm, width 2.24 mm, NMSA E7143/T2013; (2–8) paratypes: (2) length 2.95 mm, width 1.89 mm, NMSA E1005/T2212, (3) length 3.89 mm, width 2.36 mm, NMSA E255/T2016, (4) length 3.30 mm, width 2.01 mm, NMSA E255/T2016, (5) length 3.78 mm, width 2.36 mm, NMSA V1759/T2214, (6) length 3.30 mm, width 2.24 mm, NMSA E255/T2016, (7) length 3.07 mm, width 2.12 mm, NMSA E1005/T2212, (8) length 3.54 mm, width 2.24 mm, NMSA S8687/T2213. [Available in colour at http://www.africaninvertebrates.org.za]

brown, zigzag axial lines throughout (Fig. 4); last adult whorl with apical surface sometimes almost uniformly whitish, red or dark brown (Figs 5–7); rarely almost white throughout (Fig. 8).

Dimensions: Holotype (Fig. 1), length 3.30 mm, width 2.24 mm; largest specimen examined, length 4.43 mm, width 2.46 mm; l/w 1.5–1.8, a/l 0.4–0.5 (N=50).

Protoconch (Figs 9, 10): Typically trochoidean, comprising approx.1.25 whorls; apical beak present but weak, terminal lip lacking a varix, but markedly angulate at mid whorl; sculpture for the most part smooth, with traces of curved lines towards periphery, and with raised vermiculate sculpture in apical region.

Operculum (Fig. 11): Calcareous, thick and convex; paucispiral with eccentric nucleus; exterior with microscopic granular sculpture and a distinct peripheral groove underlying labral margin.

Radula (Figs 12–14): Formula $\infty + 5 + 1 + 5 + \infty$; transverse rows broadly M-shaped; rachidian tooth with broad, roundly-trigonal base-plate, lacking a cusp, but strongly overlapped by cusps of innermost laterals; base-plates of laterals overlapping extensively, the inner two with alate projections on outer margin; outermost lateral with trigonal base-plate and with a slightly smaller cusp than that of other laterals; cusp morphology of laterals somewhat variable between specimens; cusp usually with 2–4 larger central denticles and a variable number of small endocones and ectocones; one denticle frequently dominant on third and fourth laterals; innermost marginals (the first three or four) with a single broad spatulate cusp, with one strong ectocone and 1 or 2 smaller endocones; marginals progressively smaller toward edge of radula, the spatulate cusp becoming smaller and less distinct, and the ectocones finer and more numerous.

External anatomy (Fig. 15): Typically trochoidean; neck-lobes well developed, both digitate; number of digits appears to be a function of specimen size; left neck-lobe broad and outspread with ±12 digits; right neck-lobe slightly smaller and with fewer digits. Three pairs of papillate epipodial tentacles on each side, the middle one somewhat smaller than the other two; an epipodial sense organ present at base of each tentacle; epipodial fold with light brown to purple-brown pigmentation, darkest between first and second epipodial tentacles. Foot longitudinally divided, sole white. Colour pattern of head-foot variable, resembling that of shell.

Geographical range (Fig. 16): Endemic to South Africa, ranging from northern KwaZulu-Natal (Kosi Bay) to Eastern Cape (southern Transkei, Qora River).

Habitat: A subtidal species inhabiting off-shore reefs; living specimens from shallow infratidal to 70 m, empty shells from beach-drift to 140 m, exceptionally to 300 m.

Holotype: SOUTH AFRICA: *KwaZulu-Natal*: NMSA, E7143/T2013, Aliwal Shoal, Cracker Reef, dived D. Herbert, 30.iv.1989, approx. 23 m, living.

Paratypes: SOUTH AFRICA: *KwaZulu-Natal*: NMSA, W2477/T2014 (59), same collection data as holotype; D9516/T2015 (9), between Bhanga Neck and Kosi Bay, no. 13 reef, 6–18 m, living, dived D. Herbert *et al.*, 12–20.vii.1987; E1005/T2212 (31), off Durban Bluff, 18–22 m, fine sand, leg. R. Kilburn and R. Fregona, 1983; S8687/T2213 (28), Aliwal Shoal, off Scottburgh, approx.14 m, underwater pump, dived D. Herbert, 02.vi.1991; V1759/T2214 (12), Stiebel Reef, north east of Phumula (30°37'S:30°35'E), hand-dredged sand, ± 20 m, dived D. Herbert, 21.ii.1993; *Eastern Cape*: E255/T2016 (60), off Whale Rock (31°56.9'S:29°13.5'E), 20–26 m, sand and gorgonians, dredged R.V. *Meiring Naudé*, 16.vii.1982.

Additional material examined (selected samples, all NMSA): SOUTH AFRICA: northern *KwaZulu-Natal*: Leadsman Shoal, Reggie Reef, 8–12 m, a mixed algal and coral reef, 1–2 km, north of Leven Point, dived D. Herbert & NPB, 15.v.1988 (E7028); off St Lucia Lighthouse, 50 m, *ex* CSIR Water Research (A6172); Richards Bay, *ex pisce*, vi.1985, don. J.P. Marais, vii.1985 (D1578): central *KwaZulu-Natal*: off Durban Bluff, near Bluff caves, 10–15 m, dived D. Herbert, 07.v.1989 (E6544); between Umgababa and Umzimbazi River (30°08.6'S:30°56.7'E), 70 m, fine sand, dredged R.V. *Meiring Naudé*, 08.vii.1986 (E6999); Aliwal

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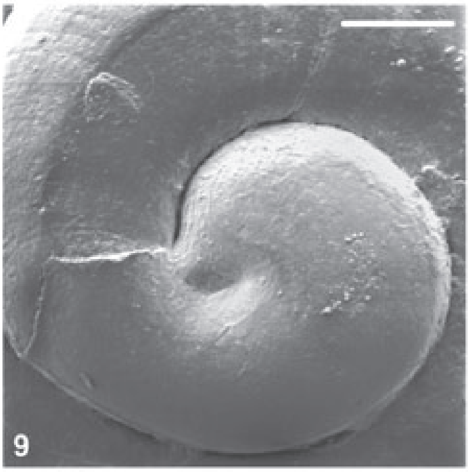
Figs 9–14. *Tricolia adusta* sp. n., SEM of protoconch, operculum and radula: (9, 10) two views of protoconch showing traces of curved lines towards periphery and raised vermiculated sculpture in apical region, NMSA W2477, bars = 50 µm; (11) external surface of operculum, showing microscopic granular sculpture and distinct peripheral groove underlying labral margin, NMSA W2586, maximum diameter 0.92 mm; (12) central portion of radula, NMSA W2586, bar = 25 µm; (13) rachidian and lateral teeth, NMSA W2586, bar = 10 µm; (14) inner marginal teeth, NMSA W2586, bar = 10 µm.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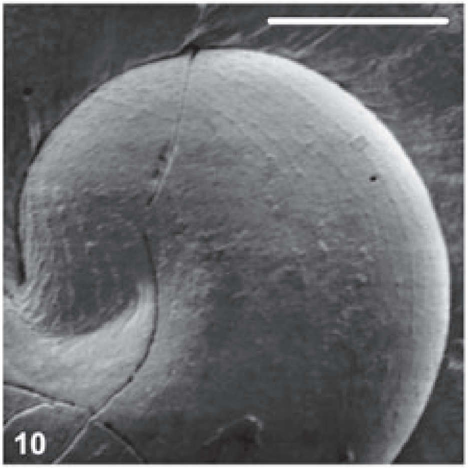
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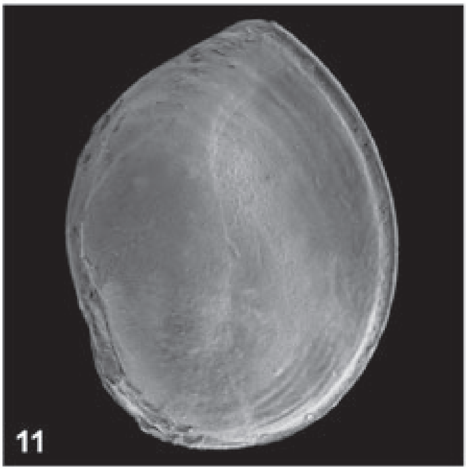
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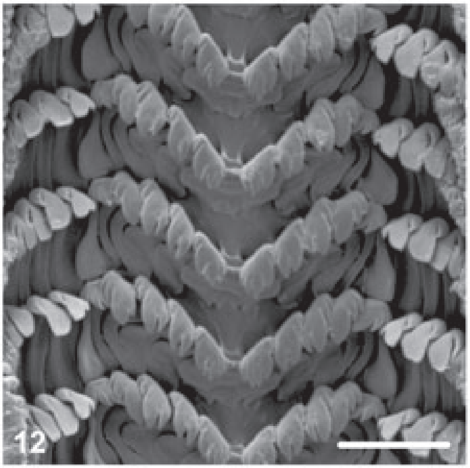
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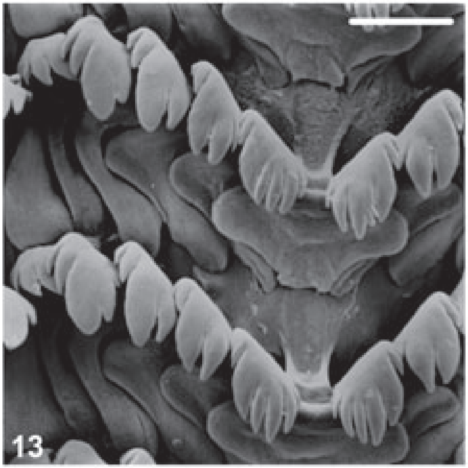
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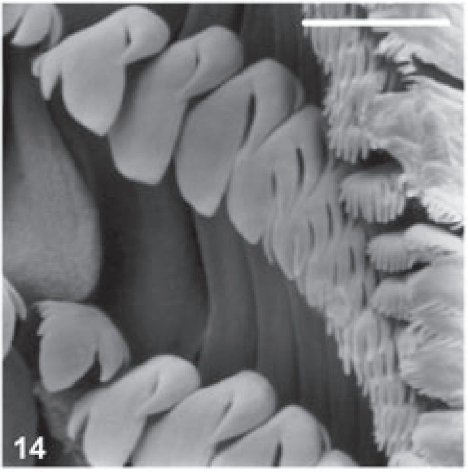
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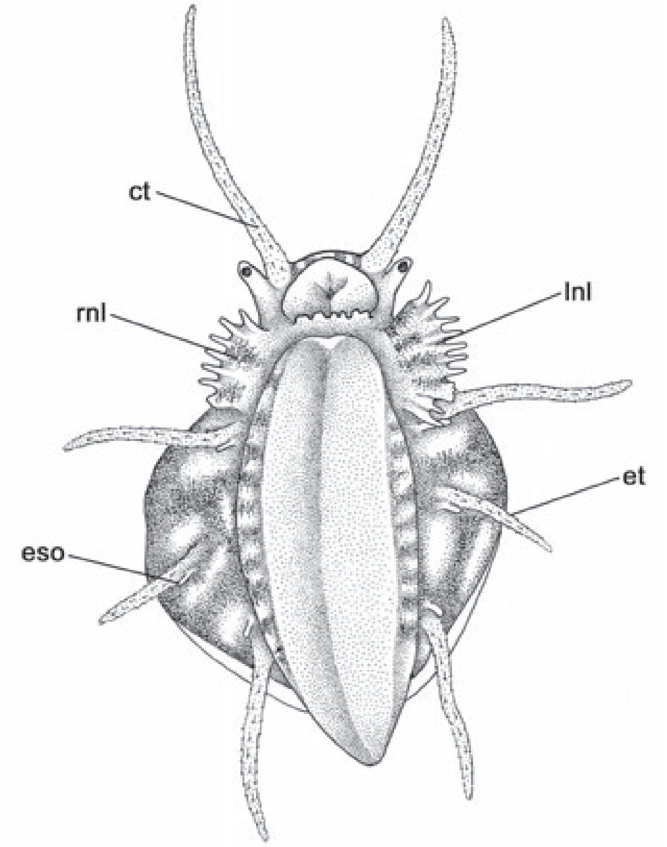


Fig. 15. *Tricolia adusta* sp. n., external anatomy: ct – cephalic tentacles; eso – epipodial sense organ; et – epipodial tentacle; lnl – left neck-lobe; rnl – right neck-lobe.

Shoal, off Umkomaas, 25–28 m, hand-dredged sand, dived D. Herbert, 16.xii.1990 (S9877); same data, (30.26690°S:30.82302°E), 15.5 m, loose rubble, dived ORI, 07.xii.2004 (W2584, living); off Scottburgh, gravel reef, 26.vii.1987 (E405); Park Rynie, 50 m, coarse sand, 25.xi.1976, *ex* CSIR Water Research, 1977 (B269); Lander's Reef, off Park Rynie, 34 m, sand, dived D. Herbert, 02.vi.1991 (S6082); southern *KwaZulu-Natal*: "B.J.'s Reef", off Hibberdene, 18–26 m, dived D. Herbert, 15.xi.1992 (V1845); off Phumula, 35 m, living on shell of *Bolma andersoni* (Smith, 1902), dived M. Wallace, viii.1996 (V4004); same data, (30°38.279'S:30°32.918'E), 36 m, on low profile reef, dived M. Wallace & V. Fraser, 07.xii.2004 (W2586, living); Glenmore Beach, south of Tongazi River mouth, intertidal rocks, leg. D. Herbert & M. Mander, 11.viii.1991 (S4123). *Eastern Cape* (Transkei): off Mtamvuna River (31°09'9"S:30°15'1"E), 140 m, sponge rubble, dredged R.V. *Meiring Naudé*, viii.1981 (C827); off Mzamba, from gut of slinger/stumpnose, leg. J.P. Marais, vii.1977 (A6650); Mzamba, beach-drift, leg. R. Kilburn & D. Herbert, 12–30.v.1986 (D2982); off Mtentu River (31°15'9"S:30°05'0"E), 50 m, shell gravel, dredged R.V. *Meiring Naudé*, 12.viii.1981 (C1689); off Port Grosvenor (31°24.6'S:29°57.2'E), 80 m, worn coral nodules, dredged R.V. *Meiring Naudé*, 16.viii.1981 (E179); same data, (29°57'6"S:31°26'2"E), 100–115 m, sand, some mud, solitary coral, shells, dredged R.V. *Meiring Naudé*, viii.1981 (C1331); Port Grosvenor (31°23.9'S:29°56.2'E), 60 m, sand, broken shell, dredged R.V. *Meiring Naudé*, viii.1981 (S3177); Mbotyi, beach-drift, leg. R. Kilburn & D. Herbert, v–vi.1985 (C8450); off Mbotyi (31°29'2"S:29°45'4"E), 50 m, mixed sand, mud, abundant worm tubes, dredged R.V. *Meiring Naudé*, viii.1981 (C1750); off Whale Rock (31°56.9'S:29°13.5'E), 20–26 m, sand and gorgonians, dredged R.V. *Meiring Naudé*, 16.vii.1982 (E6970, V4049); off Mncwasa Point (32°04.0'S:29°05.7'E), 25–30 m, fine sand, gorgonians, dredged R.V. *Meiring Naudé*, 19.vii.1982 (E341); off Qora River (32°33.6'S:28°48.8'E), 300 m, coarse sand, some broken shell, dredged R.V. *Meiring Naudé*, 11.vii.1984 (S3166).

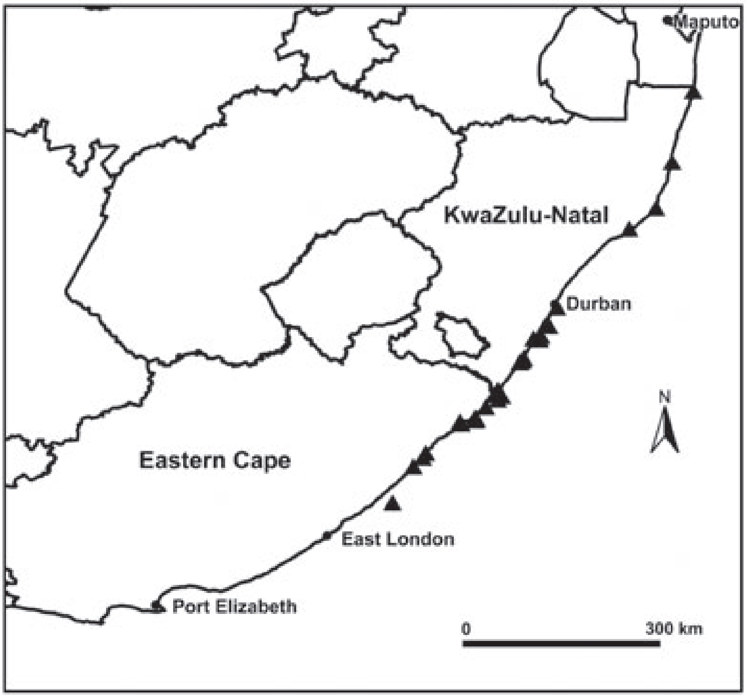


Fig. 16. *Tricolia adusta* sp. n., distribution map. Each black triangle represents one record.

Taxonomic comparison: Specimens of *T. adusta* sp. n. were previously identified under the name *T. africana* (Bartsch 1915). More thorough investigation, however, has revealed consistent differences in shell morphology. In comparison with *T. adusta*, *T. africana* is more elongate and has a higher spire, a proportionately smaller and more circular aperture, more convex whorls and frequently has light blue spots below the suture. In addition, the two species differ in terms of their habitat preferences: *T. africana* is an intertidal species, living on and under rocks in mid-shore pools, whereas *T. adusta* occurs amongst algal turf on subtidal reefs at depths of up to 70 m. In terms of shell shape *T. adusta* resembles *T. formosa* (Turton 1932), but lacks the pink spots on the apical whorls, characteristic of that species. All other species of *Tricolia* occurring in southern African differ markedly from *T. adusta* in terms of shell shape and/or sculpture.

Tricolia saxatilis sp. n.

Figs 17–28

Etymology: *saxatilis* (Latin) – found among rocks.

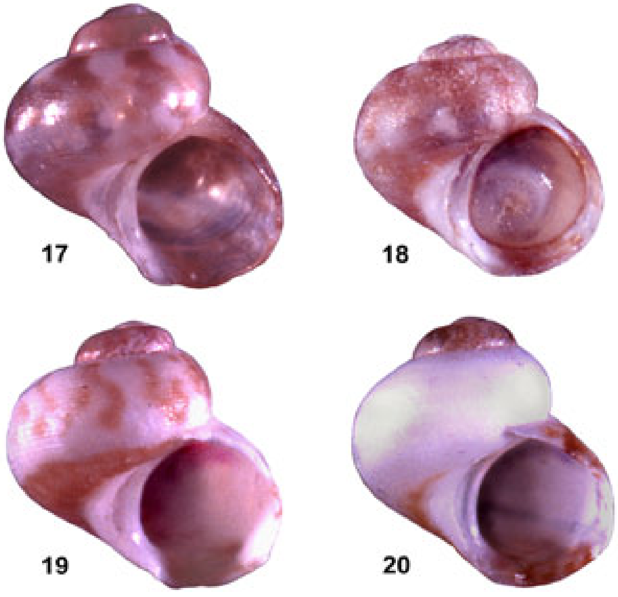
Diagnosis: Shell small and thin, turbiniform with low-spire and globose outline; whorls well rounded, suture strongly indented; sculpture of fine raised spiral threads; umbilicus open, coloration variable, usually axially patterned in shades of red or brown on a whitish or pinkish ground; operculum granulate, with a deep pit at nucleus.

Description (Figs 17–20): Shell small and thin, turbiniform with globose outline and relatively low, rounded spire; teleoconch of up to 2.25 whorls with strongly indented suture. Sculpture of fine raised spiral threads. Aperture sub-circular; umbilicus open, with a distinct channel behind inner lip leading to umbilicus. Shell somewhat translucent, coloration variable; ground colour frequently pinkish-white to dark pink or maroon, rarely tinged with amber; frequently with alternating reddish and white spots below the suture and at periphery of last adult whorl (Figs 17, 18), or with reddish axial stripes on a white ground (Fig. 19); body whorl occasionally almost uniformly white and apical whorls dark red-brown (Fig. 20); base frequently with a broad, reddish spiral band, separated from umbilicus by a similar whitish band.

Dimensions: Holotype (Fig. 17), length 2.04 mm, width 1.70 mm (= largest specimen); l/w 1.0–1.4, a/l 0.5–0.6 (N=50).

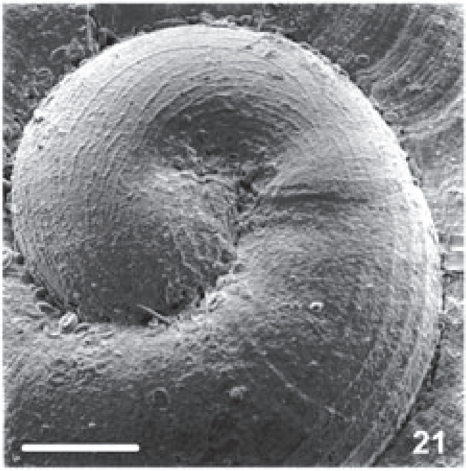
Protoconch (Figs 21, 22): Typically trochoidean, comprising approx.1.25 whorls; apical beak present but very weak, terminal lip lacking a varix and with no mid-whorl angulation; sculptured with very fine spiral lines.

Operculum (Fig. 23): Calcareous, thick and convex; paucispiral with eccentric nucleus; external surface with deep pit at nucleus and relatively coarse, irregularly granulate sculpture, and with a narrow, but distinct peripheral groove underlying labral margin.



Figs 17–20. *Tricolia saxatilis* sp. n., variation in shell colour and pattern: (17) holotype, length 2.04 mm, width 1.70 mm, NMSA V4048/T2129; (18–20) paratypes: (18) length 1.42 mm, width 1.19 mm, NMSA E7144/T2128, (19) length 1.79 mm, width 1.48 mm, NMSA S6773/T2124, (20) length 1.64 mm, width 1.32 mm, NMSA E7144/T2128.
[Available in colour at http://www.africaninvertebrates.org.za]

Figs 21–26. *Tricolia saxatilis* sp. n., SEM of protoconch, operculum and radula: (21, 22) two views of protoconch showing fine, irregular spiral sculpture, NMSA W2585, bar = 60 µm; (23) external surface of operculum, showing irregularly granulate sculpture and deep pit at nucleus, NMSA W2585, maximum diameter 0.64 mm; (24) central portion of radula, NMSA W2585, bar = 50 µm; (25) lateral and inner marginal teeth, NMSA W2585, bar = 15 µm; (26) inner marginal teeth, NMSA W2585, bar = 10 µm.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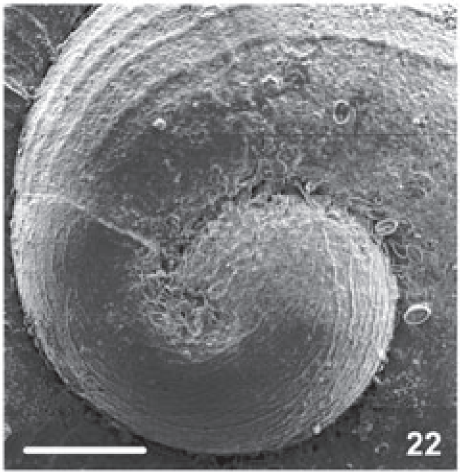
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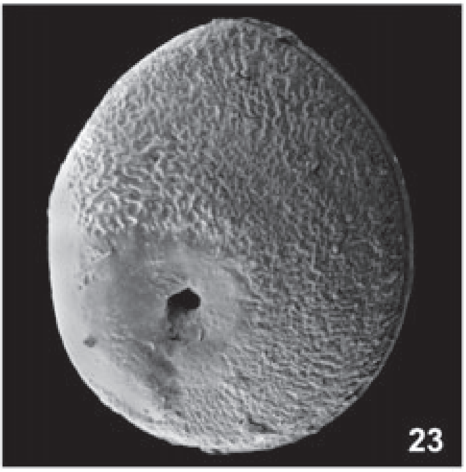
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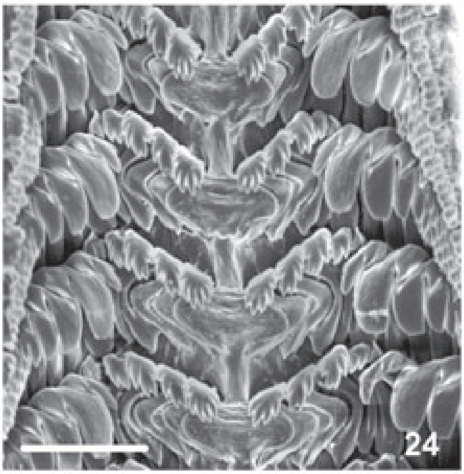
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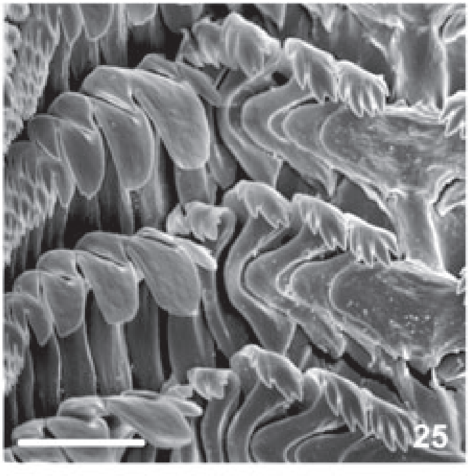
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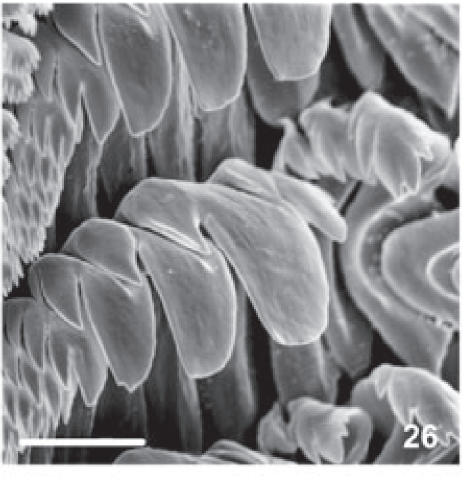
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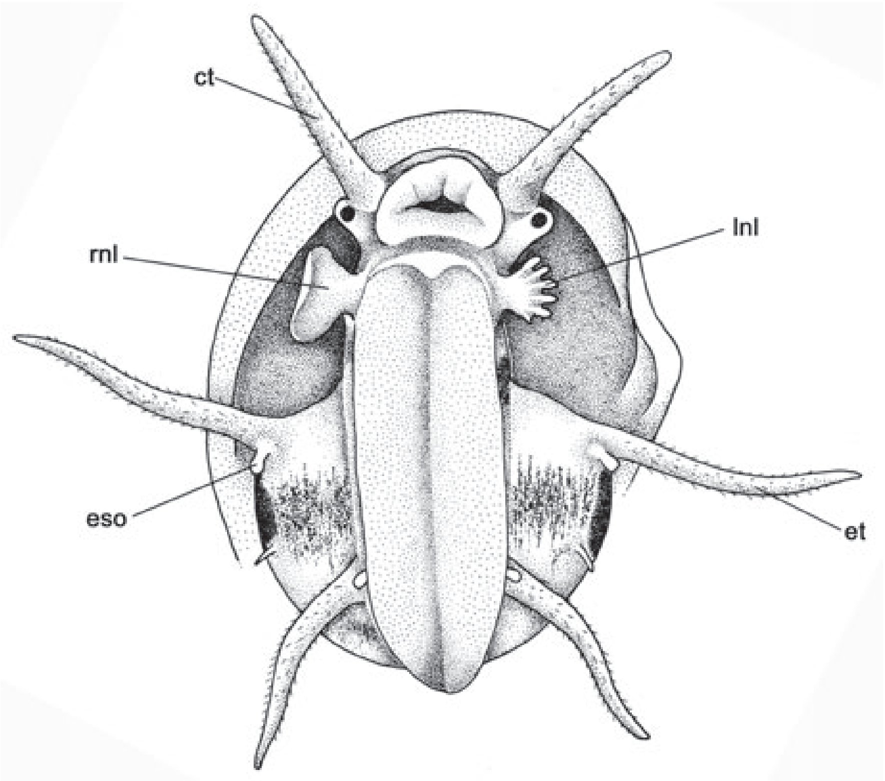

Fig. 27. *Tricolia saxatilis* sp. n., external anatomy: ct – cephalic tentacles; eso – epipodial sense organ; et – epipodial tentacle; lnl – left neck-lobe; rnl – right neck-lobe.

Radula (Figs 24–26): Similar to *T. adusta* sp. n., but denticles on cusps of innermost laterals more or less equal in size.

External anatomy (Fig. 27): Typically trochoidean, but differs from most *Tricolia* species in the form of the neck-lobes – left neck-lobe broad with ±5 digits, right neck-lobe broad and smooth; middle epipodial tentacle much smaller than the other two, with no sense organ evident at its base.

Geographical range (Fig. 28): Endemic to South Africa, ranging from northern KwaZulu-Natal (Zululand) to Eastern Cape (Port Alfred).

Habitat: A subtidal species inhabiting off-shore reefs; living specimens 8–36 m, empty shells to 50 m.

Holotype: SOUTH AFRICA: *Eastern Cape*: NMSA, V4048/T2129, off Whale Rock (31°56.9'S:29°13.5'E), 20–26 m, sand and gorgonians, dredged NMDP, 16.vii.1982.

Paratypes (all NMSA): SOUTH AFRICA: *Eastern Cape*: W4299/T2215 (3), same data as holotype. *KwaZulu-Natal*: E7144/T2128 (11), Aliwal Shoal, Cracker Reef, approx.23 m, living, dived D. Herbert, 30.iv.1989; W2585/T2127 (33), Aliwal Shoal (30.26690°S:30.82302°E), approx.15.5 m, loose rubble, living, dived ORI, 07.xii.2004; W2582/T2125 (8), Aliwal Shoal (30.26017°S:30.82775°E), ±8 m, loose rubble, living, dived ORI, 09.xii.2004; S6773/T2124 (52), Aliwal Shoal, 10–20 m, sand, dived D. Herbert, 30.vi.1991; S8662/T2119 (61), Aliwal Shoal, approx.14 m, underwater pump, dived D. Herbert, 02.vi.1991; S8215/T2120 (52), Aliwal Shoal, 10 m, sand and reef debris, hand-dredged, D. Herbert, 04.iv.1992; W2717/T2126 (1), off Phumula (30°38.279'S:30°32.918'E), approx.36 m, low profile reef, living, dived M. Wallace & V. Fraser, 07.xii.2004.

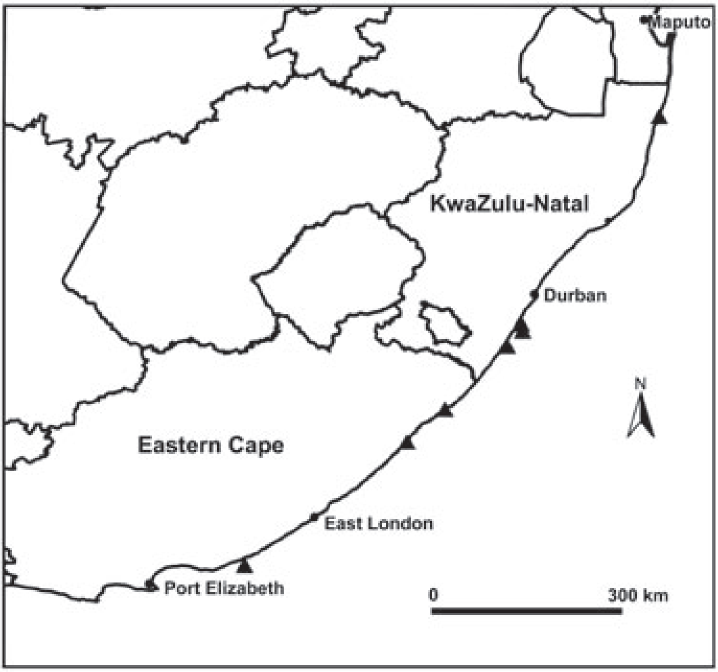

Fig. 28. *Tricolia saxatilis* sp. n., distribution map. Each black triangle represents one site record.

Additional material examined (all NMSA): SOUTH AFRICA: northern *KwaZulu-Natal*: off Hully Point (27°20.2'S:32°46.2'E), 40 m, very fine muddy sand, algae, dredged R.V. *Meiring Naudé*, 05.vi.1987 (E1458); central *KwaZulu-Natal*: off Park Rynie, 50 m, coarse sand, *ex* CSIR Water Research (B5666); Aliwal Shoal, ± 16 m, hand-dredged sand, dived D. Herbert, 26.v.1990 (S5992); same data, 9–15 m, dived D. Herbert & R. Emanuel, 27.xi.1988 (E6197, E6273); Aliwal Shoal, approx.20 m, hand-dredged sand, dived D. Herbert, 25.x.1992 (S7920); Aliwal Shoal, 25–27 m, sand and reef debris, hand-dredged D. Herbert, 04.iv.1992 (S7158); Aliwal Shoal, off Umkomaas, 25–28 m, hand-dredged sand, dived D. Herbert, 16.xii.1990 (S9881). *Eastern Cape*: off Mbotyi (31°29.2'S:29°45.4'E), 50 m, sand, dredged R.V. *Meiring Naudé*, viii.1981 (E185); off Port Alfred (33°42'S:26°56'E), 65 m, *ex* gut *Congiopodus torvus*, leg. D. Herbert on R.V. *Africana*, 3.v.1997 (V5161).

Taxonomic comparison: In comparison with all other species of *Tricolia* occurring in southern Africa, *T. saxatilis* is smaller, lower-spired, has more convex whorls, and a more distinct umbilicus. In its globose shape and small size, *T. saxatilis* resembles *T. deschampsi* Gofas, 1993, *T. entomocheila* Gofas, 1993, *T. nordsiecki* (Talavera, 1978), *T. punctura* Gofas, 1993, and *T. tingitana* Gofas, 1982, from the Mediterranean. It differs notably from these, however, in its coarsely granular, pitted operculum.

CONCLUSIONS

Characters of the radula and external anatomy suggest that *T. adusta* and *T. formosa* are related and differ somewhat from most of the other endemic South African species, which resemble the type species, *T. pullus* (Linnaeus, 1758), in these features. The inner marginal teeth of the radula of *T. adusta* and *T. formosa* have one strong undivided ectocone, whereas in *T. pullus* and the other endemic southern African species, the ectocone of the inner marginal teeth is bifid or notched, and interlocks with two notches at the base of the cusp of the adjacent outer tooth (Nangammbi, unpublished data). In terms of the external anatomy, *T. adusta* and *T. formosa* have one sense organ at the base of each epipodial tentacle, whereas *T. pullus* and the other endemic southern African species have two sense organs at the base of the anterior epipodial tentacle on the right (Nangammbi, unpublished data).

In *T. saxatilis*, the inner marginal radula teeth are of the same form as in *T. adusta* and *T. formosa*, but its shell shape, operculum sculpture and external anatomy differ markedly from those of the latter species. The coarsely granular external surface of the operculum in *T. saxatilis*, and its deep pit, are distinctive. A similar pit has been reported from juvenile *Tricolia* species (Robertson 1985), suggesting that this might be a paedomorphic character, and is concordant with the small size of the species. The form of the neck-lobes of *T. saxatilis* resembles that of the Mediterranean *T. tingitana*, in that the left neck-lobe of both species has relatively few digits and the right-lobe is broad with a non-digitate margin (Gofas 1986, 1993). Additionally, in *T. tingitana* the terminal lip of the protoconch, like that of *T. saxatilis*, lacks a distinct angulation. The possibility thus exists that *T. saxatilis* may be more closely related to *T. tingitana* and perhaps other small Mediterranean *Tricolia* species than it is to the larger, conchologically more typical species. However, some of these shared features may perhaps result from convergence related to size reduction and further comparative study will be required to clarify this. None of the small Mediterranean species appears to possess the coarsely granular operculum with a nuclear pit seen in *T. saxatilis*.

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